National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 886

Refractory Gold Ore

(In Cooperation with the American Society for Testing and Materials)

This Standard Reference Material (SRM) is a refractory gold ore of the Carlin type, in the form of fine powder (nominal particle size between 50 and 100 μm (<150, >300 mesh)). SRM 886 is intended for use in evaluating chemical and instrumental methods for the analysis of gold ores. The SRM is provided as a 200 g unit.

The certified values for the gold and sulfur concentration are reported on an as-received basis. The value for gold was determined by gravimetric fire assay and by acid decomposition-HBr extraction-atomic absorption spectrometry, and is the present "best estimate" of the true value. The certified value for sulfur was determined by isotope dilution thermal ionization mass spectrometry following Carius tube decomposition [1] of samples of 0.1 g to 0.2 g.

The uncertainty stated for gold includes between-laboratory and within-laboratory components of uncertainty. No material variability was detected for samples of 5 g or more. The uncertainty stated for sulfur includes a component of uncertainty for material variability (the standard uncertainty for this source is approximately 3% relative), as well as components of uncertainty due to the measurement process. Uncertainties are expanded as described in reference [2]. Each expanded uncertainty defines a range of values for its certified value within which the true value is believed to lie, at a level of confidence of approximately 95%.

Gold concentration.....	8.25 ±	0.13 mg/kg
Sulfur concentration.....	1.466 ±	0.044 Wt %

PLANNING, PREPARATION, TESTING, ANALYSIS

The SRM gold ore was collected by Newmont Exploration Limited, Carlin, NV at the Carlin black carbon ore stockpile. A total of 330 kg was dried and crushed to minus 7 mm (- 1/4 in). The material was then ground to fine powder (98% less than 150 μm (100 mesh)) by Chemex Laboratories, Ltd. in Nevada before shipment to NIST as a candidate SRM.

Further processing to segregate the middle size fraction of 50 to 100 μm (150 to 300 mesh) from the coarser and finer fractions, blending, and bottling of the material in 200 g units was performed by the U.S. Geological Survey under contract with NIST. The middle fraction accounted for approximately 30% of the original sample. One-gram samples were taken prior to bottling and analyzed for gold by a HBr/Br_2 leach procedure to assess homogeneity. Since the leach procedure recovered only approximately 90% of the gold present, further homogeneity assessments of the bottled material were made by analyzing 20 ten-gram samples by fire-assay and 24 five-gram samples by acid decomposition/solvent extraction/atomic absorption analysis. Samples of 0.25 g were also analyzed for carbon and sulfur by combustion-IR detection to further assess the sample homogeneity prior to bottling. All homogeneity measurements indicate that material variability is negligible.

Gaithersburg, MD 20899
March 6, 1995
(Revision of certificate dated 4-12-93)

Thomas E. Gills, Chief
Standard Reference Materials Program

(over)

The overall coordination of the technical measurements leading to certification of gold were performed under the direction of C. Bucknam, Newmont Metallurgical Services. Mass spectrometric analyses for sulfur were performed by W.R. Kelly and R.D. Vocke, Jr. of the NIST Analytical Chemistry Division.

Statistical evaluation of the certification data was performed by S.B. Schiller of the NIST Statistical Engineering Division.

The technical and support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program by J.S. Kane.

ADDITIONAL INFORMATION ON THE COMPOSITION

Specific chemical forms of carbon and sulfur were also determined, and values are indicated below. These constituents have an important impact on the selection of the ore beneficiation process. The values are not certified, but are reported as additional information on the composition of the ore.

Constituent	Concentration Wt %
Carbon, total	5.7
Carbon, inorganic	5.4
Sulfate Sulfur	0.7
Sulfide Sulfur	0.8

Mineralogical analyses were performed by X-ray diffraction and X-ray fluorescence analysis to provide bulk matrix information. The mineralogic content is approximately:

Mineral	Wt %
Quartz	34
Dolomite	31
Calcite	20
Sericite	8
Kaolin	4
Pyrite	3

Cooperative analyses for certification were performed by the following laboratories:
Newmont Metallurgical Services, Salt Lake City, UT, C. Bucknam
Newmont Gold Company, Carlin, NV, P. Braun
Barrick Goldstrike Mines, Carlin, NV, R. Richardson
Chemex Laboratories, Ltd., North Vancouver, BC Canada, L. Twaites
Amax Gold Company, Winnemucca, NV, J.L. Oleson
U.S. Geological Survey, Denver, CO, S.A. Wilson
Institute of Non-Ferrous Metals, Gliwice, Poland, W. Stankiewicz, M. Brzezicka, and E. Szmyd

REFERENCES

[1] Kelly, W.R., Paulsen, P.J., Murphy, K.E., Vocke, R.D., Jr., and Chen, L-T, (1994), Anal. Chem. 66: 2505-2513.

[2] *"Guide to the Expression of Uncertainty in Measurement"*, ISBN 92-67-10188-9, 1st Ed. ISO, Geneva, Switzerland, (1993).